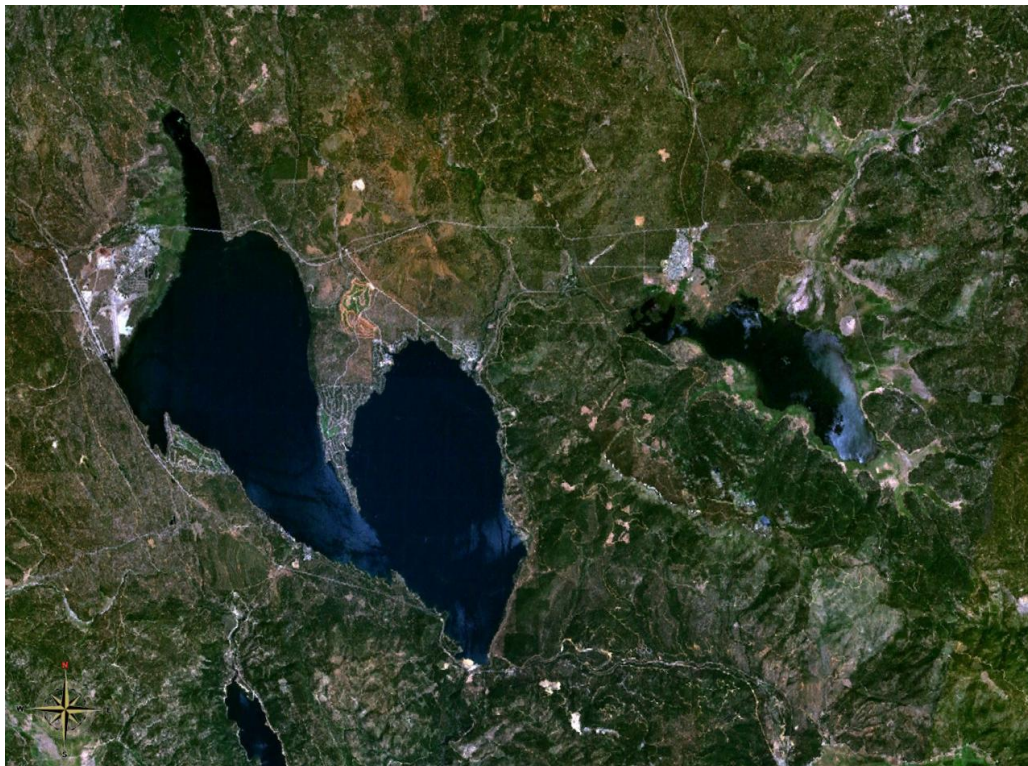# Improving Hydrological Snowpack Forecasting for Hydropower Generation Using Intelligent Information in a warming climate

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Prof. Martha Conklin
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PG&E

STATE OF CALIFORNIA
ENERGY COMMISSION

UCMERCED

DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

**2018 Electric Program Investment Charge
(EPIC) Symposium
Sacramento, CA -- February 7 2018**

Project objective

Feather River basin
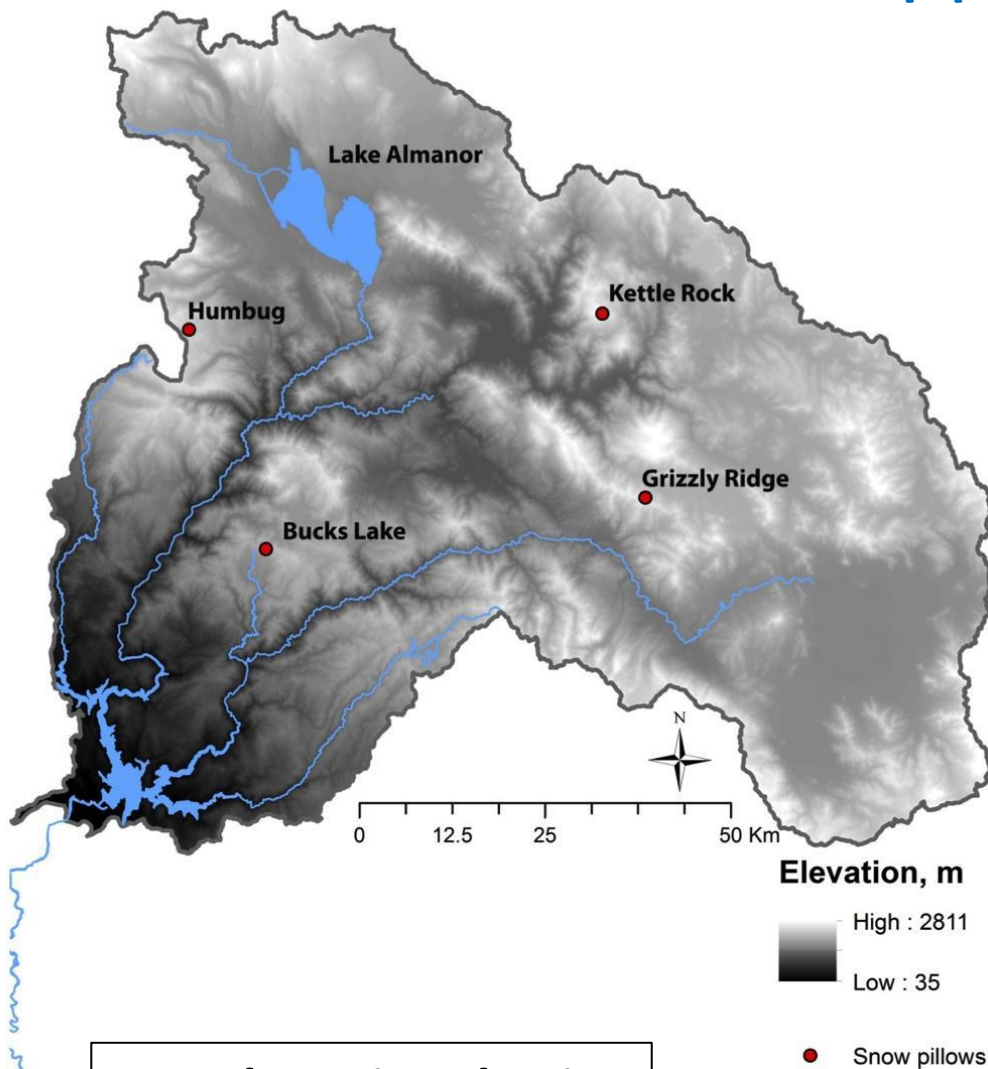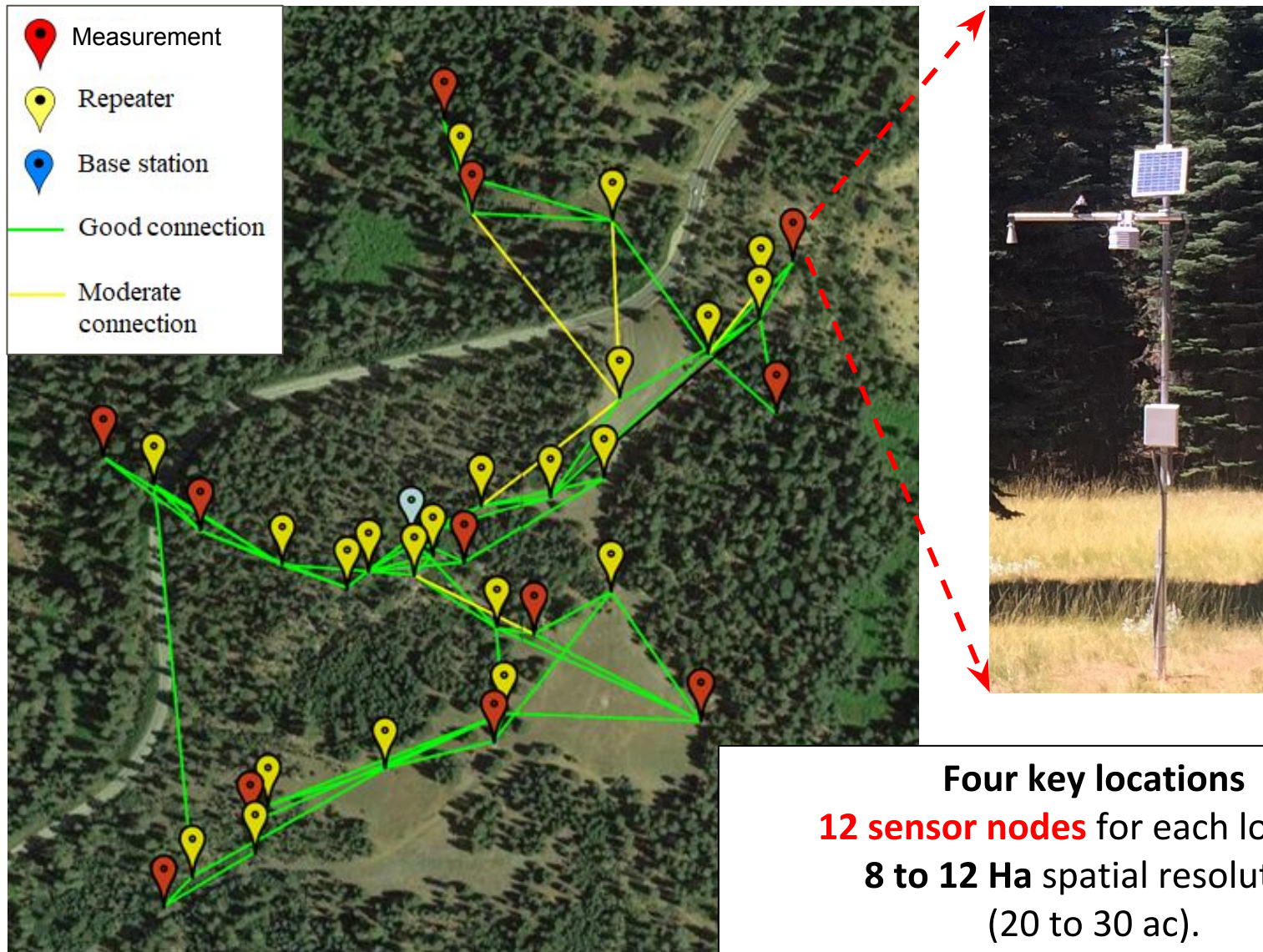
Quantify and reduce **uncertainty in water resources forecasts** owing to a changing climate.

North Fork Feather River Hydroelectric Project

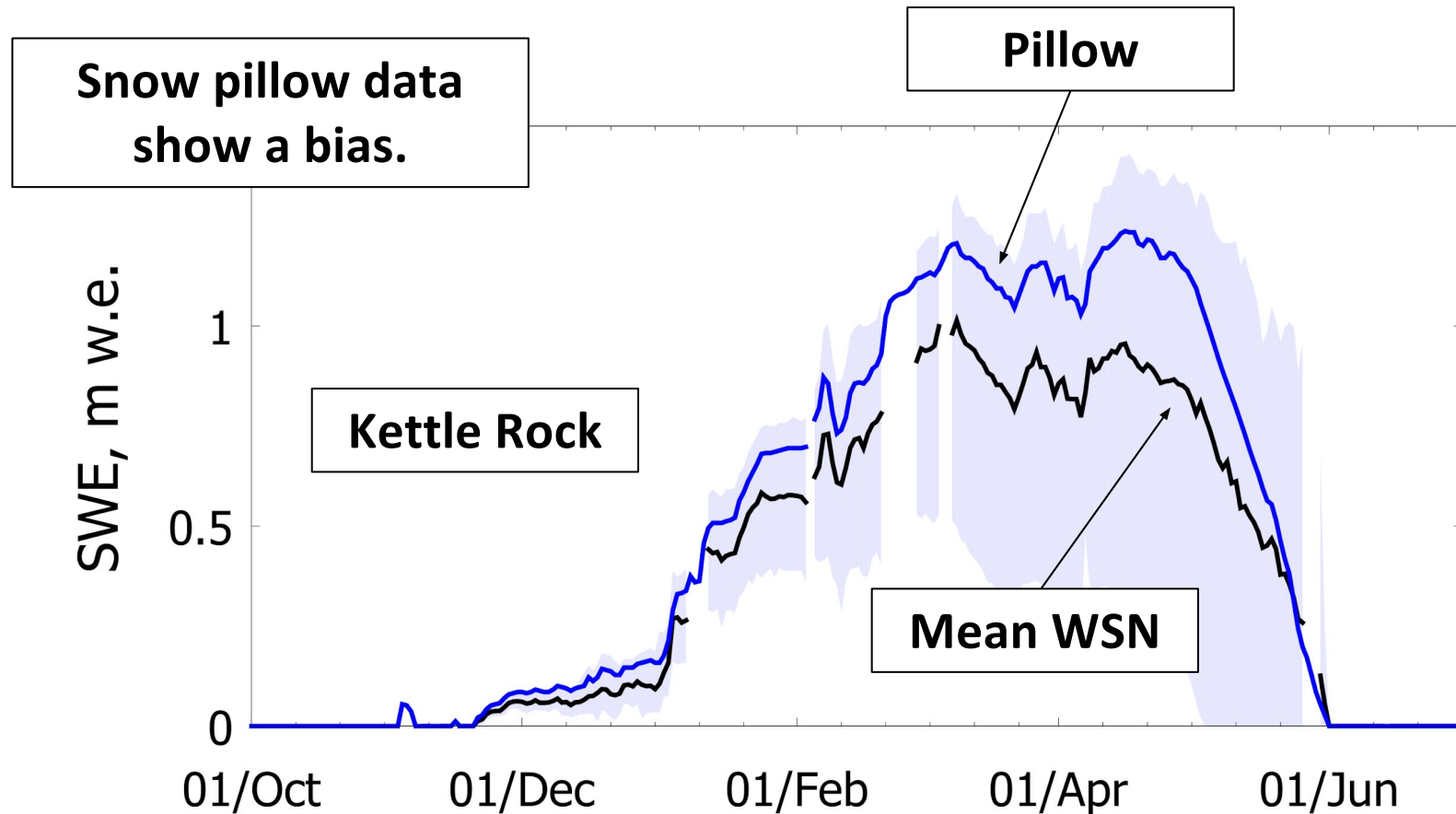- ***3 reservoirs** (1,150 TAF)*
- ***10 powerhouses** (734 MW)*
- *Upstream of **Lake Oroville***

Real-time wireless sensor networks

Legend:
- Measurement
- Repeater
- Base station
- Good connection
- Moderate connection

Four key locations
12 sensor nodes for each location
8 to 12 Ha spatial resolution
(20 to 30 ac).

Wireless sensor networks track **representative patterns of water content** based on physiographic variables.

Snow pillow data show a bias.

Pillow

Kettle Rock

Mean WSN

SWE, m w.e.

01/Oct   01/Dec   01/Feb   01/Apr   01/Jun

We use machine learning to blend **ground data** and **remote sensing** to estimate snow-water content at **high resolution.**

SWE (mm)
High : 2430
Low : 0

● WSNs
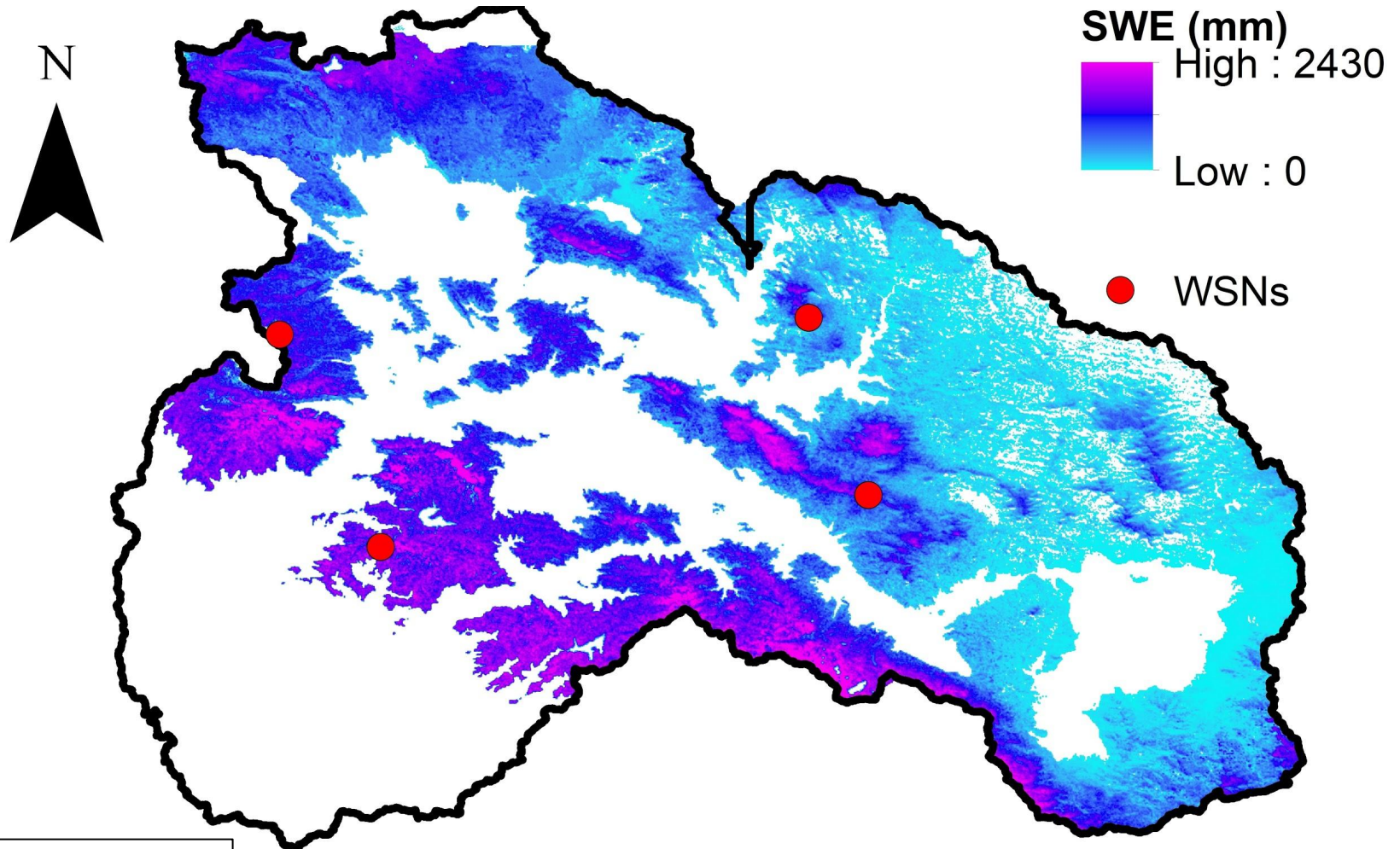
April 1 2017
(prelim. results)

20 10 0   20 Kilometers
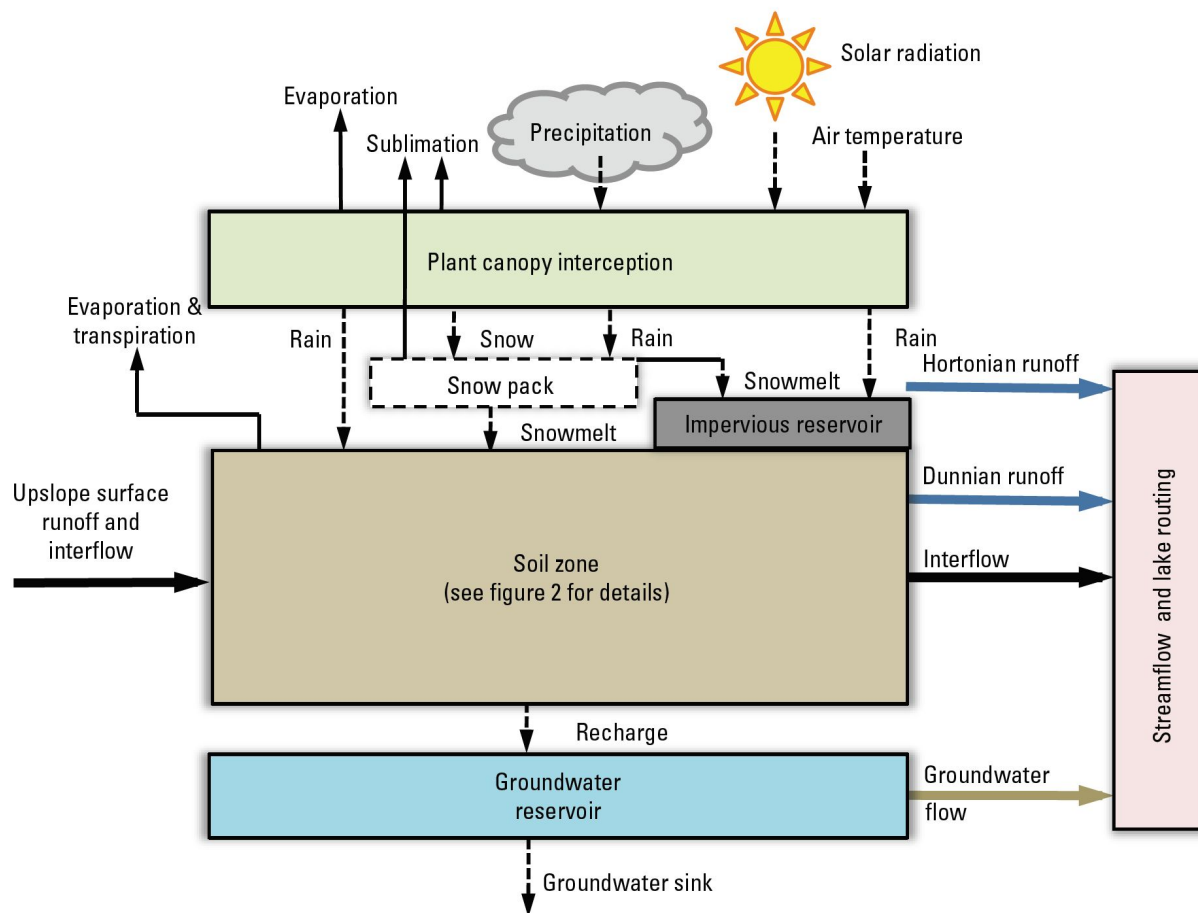
WSN = wireless sensor network

Summary and future directions

We are developing <u>core elements</u> of a **next generation hydrographic data network.**

The network can **support hydropower decision makers in real time** with more information about the snowpack state.

Data are being used to **improve** current decision-support tools for hydropower like the **<u>PRMS model</u>**.

Data from wireless sensor networks provide forecasters with more data for **calibration, validation**, and **assimilation.**
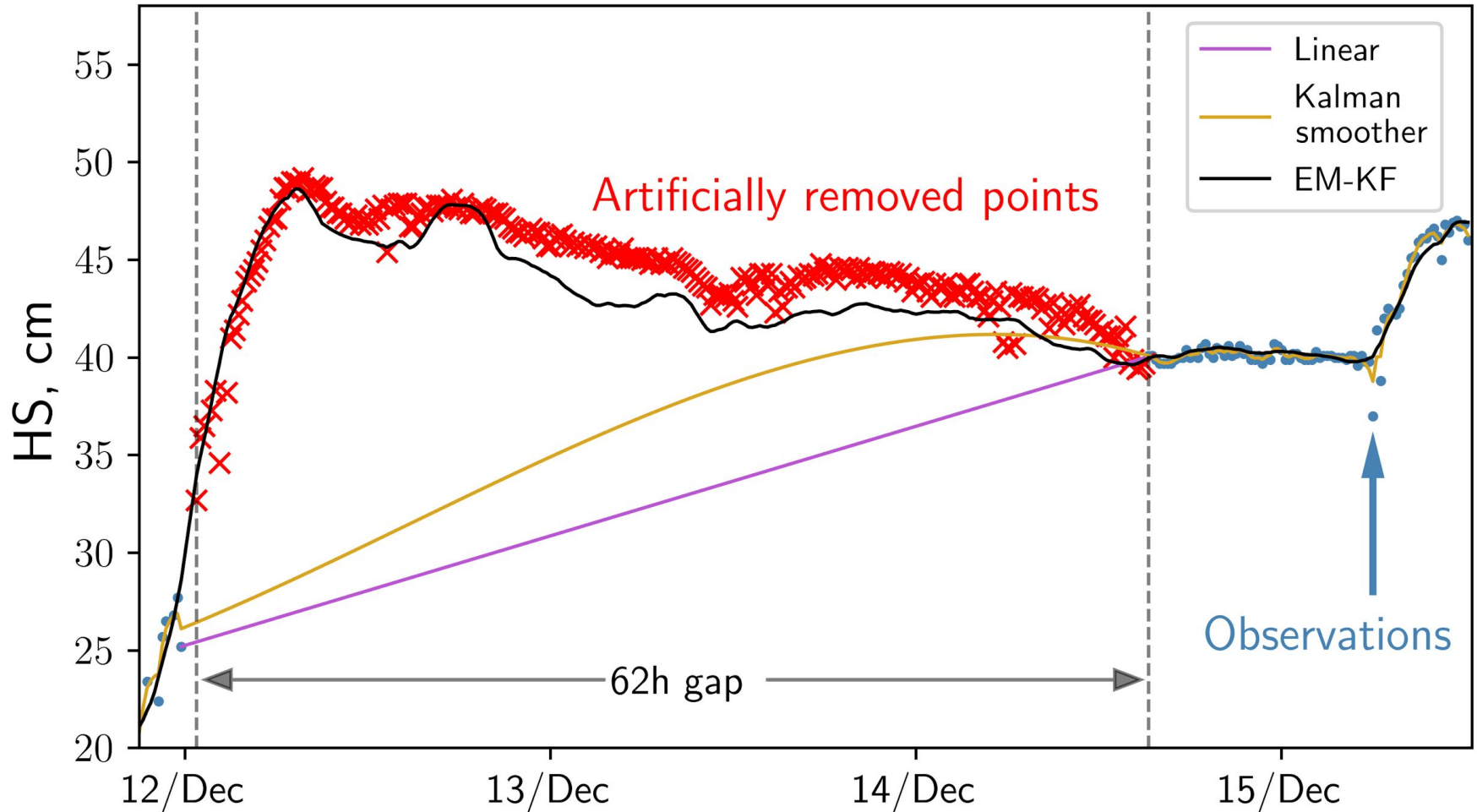
USGS PRMS model

Wireless sensor networks allow forecasters to **fill gaps in data** using <u>machine learning</u> and spatial consinstency.

Results by Adam Coogan, UC Santa Cruz

Uncertainty in water-resources forecasting is a **global issue**: today California, tomorrow the world.